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Attorney Docket No.: 8194-541 PATENT

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Guey et al.
Serial No.: 09/610,050
Filed: July 5, 2000
Title: DELAY AND CHANNEL ESTIMATION FOR MULTI-CARRIER CDMA SYSTEM

Examiner: Daniel J. Ryman
Group Art Unit: 2665
Confirmation No.: 4708

September 9, 2004

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Alexandria, VA 22313-1450

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §1.192

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION--37 C.F.R. § 1.192)

1. Transmitted herewith, in triplicate, is the APPEAL BRIEF for the above-identified application, pursuant to the Notice of Appeal filed on July 7, 2004 and received by the USPTO on July 9, 2004.

2. This application is filed on behalf of
   ☐ a small entity.

3. Pursuant to 37 C.F.R. § 1.17(c), the fee for filing the Appeal Brief is:

☐	small entity	$165.00
☒	other than small entity	$330.00

Appeal Brief fee due $330.00

☒ Any additional fee or refund may be charged to Deposit Account 50-0220.

Respectfully submitted,

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Audra Wooten

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Sir:

This Appeal Brief is filed pursuant to the "Notice of Appeal to the Board of Patent Appeals and Interferences" mailed July 7, 2004, and received at the USPTO on July 9, 2004.

Real Party In Interest

The real party in interest is assignee Ericsson Inc., a Delaware corporation having a principal place of business at Research Triangle Park, North Carolina.

Related Appeals and Interferences

Appellants are aware of no appeals or interferences that would be affected by the present appeal.

Status of Claims

Appellants appeal the rejection of Claims 1-31, which as of the filing date of this Brief remain under consideration. The attached Appendix A presents the claims at issue as rejected in the Official Action of April 7, 2004 (the Official Action).

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Status of Amendments

There have been no amendments filed subsequent to the Official Action. The attached Appendix A presents the claims as amended by the Amendment of February 26, 2004.

Summary of the Invention

In some embodiments according to the present invention, a multi-carrier CDMA receiver can identify multiple paths and relative delays by considering a multi-carrier signal as an entire wideband signal and can perform estimation using the known signals in all (or at least more than one) subcarrier. Furthermore, a receiver can receive the signal transmitted via multiple subcarriers each having a known pilot sequence. A plurality of down-converters down-convert the received signal to different baseband signals. A channel estimator can correlate the baseband signals to produce an estimate of channel gain and multi-path delay. A polarity of demodulators (one for each of the subcarriers) can be coupled to the delay in channel estimator so that each demodulator demodulates one of the baseband signals using the estimated channel gain in multi-path delay. *Application, page 3, lines 2-10.*

For example, in some embodiments according to the invention as illustrated for example in Figure 4 and discussed at page 11, lines 16 – 21 of the application, a wideband signal R(t) is provided to a number of multipliers 40-1, 2, and 3. The multipliers down-convert the wideband signal R(t) to provide three separate baseband signals to respective baseband filters (42-1, 2, and 3). According to Fig. 4, the wideband signal R(t) is a multi-carrier CDMA signal where each of the multipliers 40-1, 2 and 3 down converts the corresponding carrier to a baseband signal. In other words, **the wideband signal R(t) includes multiple carriers** where each of the multipliers is configured to down-convert a separate carrier signals to provide the corresponding baseband signal carried by each of the respective carriers including in the multi-carrier CDMA signal R(t).

Issues

Are Claims 1-31 properly rejected under 35 U.S.C. § 103(a) as unpatentable over various combinations of United States Patent No. 5,870,378 to Huang et al. (hereinafter "Huang"), and United States Patent No. 6,097,712 to Secord et al. (hereinafter "Secord")?

Grouping of Claims

Group I: Claims 1-31 stand or fall together.

Argument

I. Introduction

The Group I Claims (Claims 1-31) stand rejected under 35 U.S.C. § 103(a) over various combinations of references including Huang and Secord. A determination under § 103 that an invention would have been obvious to someone of ordinary skill in the art is a conclusion of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1593, 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987), *cert. denied*, 107 S.Ct. 2187. After the involved facts are determined, the decision maker must then make the legal determination of whether the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was made. *See Panduit*, 810 F.2d at 1596. The United States Patent and Trademark Office (USPTO) has the initial burden under § 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

To establish a *prima facie* case of obviousness, the prior art reference or references when combined must teach or suggest *all* the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *See* M.P.E.P. § 2143. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *See* M.P.E.P. § 2143.01(citing *In re Mills* , 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990)). As emphasized by the Court of Appeals for the Federal Circuit, to support combining references, evidence of a suggestion, teaching, or motivation to combine

must be clear and particular, and this requirement for clear and particular evidence is not met by broad and conclusory statements about the teachings of references. *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). In another decision, the Court of Appeals for the Federal Circuit has stated that, to support combining or modifying references, there must be particular evidence from the prior art as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed. *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000).

Furthermore, as stated by the Federal Circuit with regard to the selection and combination of references:

> This factual question of motivation is material to patentability, and could not be resolved on subjective belief and unknown authority. It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983). Thus the Board must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency's conclusion....

In re Sang Su Lee, 277 F.3d 1338, 1343 (Fed. Cir. 2002).

The patentability of the pending claims is discussed further below.

II. The Group I Claims Are Patentable Over the Cited References

Claims 1-31 stand rejected under 35 U.S.C. § 103 over Huang and Secord in combination with several other references. In particular, independent Claims 1, 7, 11, 19, and 25 stand rejected over Huang in view of Secord. Independent Claims 13 and 31 stand rejected over Huang in view of Secord and further in view of U.S. Patent No. 5,481,570 to Winters ("Winters"). *Official Action, pp. 3 and 10.* As discussed below in greater detail, Appellants' arguments focus on the rejections based on the irrelevance of Huang and its' improper combination with Secord. Accordingly, Appellants' arguments herein address the rejections of all the independent claims together to the extent that all of the rejections in the Official Action rely on the combination of Huang and Secord.

Appellants respectfully submit that even if Huang and Secord were combined, the combination would not disclose or suggest all of the recitations of independent claims 1, 7, 11, 13, 19, 25, and 31. For example, Huang and Secord, either singularly or in combination do not disclose or suggest at least:

> A receiver for **a multi-carrier CDMA system for receiving a signal transmitted on plural sub-carriers** each having a known pilot sequence, comprising:
>
> a plurality of down-converters down-converting the received signal to different data baseband signals;
>
> a delay and channel estimator correlating at least one of the different data baseband signals with a single wideband pilot signal, the single wideband pilot signal comprising more than one of the known pilot sequences, to produce an estimate of channel gain and multi-path delay; and
>
> **a plurality of' demodulators, one for each of the plural sub-carriers**, and operatively coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

Independent Claim 1. Independent Claims 7, 11, 13, 19, 25, and 31 include similar recitations.

As understood by Appellants, Huang relates to **multi-code** processing, which is commonly referred to as conventional Code Division Multiple Access (CDMA). In contrast, embodiments according to the invention **relate to multi-carrier, not multi-coding**. For example, Huang states that:

> In accordance with the present invention, we have further reduced the circuitry and associated cost and power consumption of a **Multi-Code** (MC) Code Division Multiple Access (CDMA) receiver for receiving N (where N.gtoreq.1, N is typically a power of 2) encoded signal channels over multiple air paths. The reduction in the receiver circuit is the result of encoding (spreading) these N channels using common subcode sequences. More specifically, each of the N binary spreading codes is length N.sub.c chips, where N.ltoreq.N.sub.c and where N.sub.c is an integer multiple of N, and each is encoded uniquely using N subcode sequences which are length N.sub.c /N. For any of the N codes, the nth subcode sequence, where n=1, 2, . . . , N, is either H.sub.n or its binary inverse H.sub.n.sup.'. Once a timing (first type) correlator means has recovered the timing and control signals for a preselected signal channel received over any particular signal path, those timing and control signals are utilized by a second correlator means which includes simplified circuitry embodied by a **Fast Walsh-Hadamard Transformation**

> **(FWHT) for demodulating the N data** signal channels received over that path.

Huang, column 1, lines 61 – 65 and column 2, lines 1 – 13 (emphasis added).

As demonstrated by the above cited passage from the summary of the invention in Huang, the systems discussed therein relate to multi-coding, not multi-carrier processing. As is well understood by those skilled in the art, CDMA allows users to be allocated a particular code (*e.g.* from a WALSH code) which enables the user to de-spread a signal intended for the user. In other words, different codes in a CDMA system can be provided to different users so that each of the uses can despread the respective signal intended for the user. Moreover, as discussed in Huang, more than one code can be allocated to users of the system so that certain users may have access to increased bandwidth. For example, as understood by Appellants, in some of the systems discussed in Huang, a user may be provided with two or more codes (*i.e.* multi-codes) in the CDMA system so that the user can de-spread more than one signal in the same wideband signal.

However, the multi-coding discussed in Huang is not a multi-carrier system. In other words, the systems discussed in Huang provides multiple code for dispreading of signals provided using a single carrier, not multiple carriers or (subcarriers) as claimed in the present invention. **Appellants believe that the Examiner may be confusing the acronym M-C CDMA to mean multi-carrier rather than the actual multi-coding discussed in Huang**.

In further contrast to Huang, as shown for example in Figure 4 of the present application, a wideband signal R(t) includes multiple subcarriers evidenced by the fact that the separate multipliers 40-1, 2 and 3 each down-convert separate subcarriers included in the wideband signal R(t) to provide separate baseband signals to the respective baseband filters 42-1, 2 and 3. Accordingly, in some embodiments according to the invention, multiple carriers are used in a wideband CDMA system, which is very different than the conventional multi-coding CDMA system discussed in Huang, which does not even mention multiple carriers. Accordingly, Huang does not disclose or suggest at least the emphasized portions of the recitations of independent claims discussed above.

Appellants submit that Secord also does not disclose or suggest all the recitation of the independent claims, including those discussed above in reference to Huang. In addition, Secord also does not disclose or suggest other recitations of the independent claims. For example, independent Claim 1 recites in-part:

> a plurality of down-converters down-converting the received signal to different data baseband signals;
>
> **<u>a delay and channel estimator correlating at least one of the different data baseband signals with a single wideband pilot signal, the single wideband pilot signal comprising more than one of the known pilot sequences, to produce an estimate of channel gain and multi-path delay</u>**; and
>
> a plurality of' demodulators, one for each of the plural sub-carriers, and operatively coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

Independent Claims 7, 11, 13, 19, 25, and 31 include similar recitations.

In some embodiments according to the invention, as shown for example in Figs. 4 and 5 of the present application, the baseband filters 42-1, 42-2, and 42-3 each filter a different one of the baseband sub-carrier signals as indicated by the respective dashed region of interest shown. For example, baseband filter 42-1 is configured to pass the baseband sub-carrier signal that corresponds to the region of interest shown in 42-1, whereas the baseband filter 42-2 is configured to pass a different data baseband sub-carrier signal (*i.e.*, a second baseband sub-carrier signal that includes different data from the first baseband sub-carrier signal passed by the baseband filter 42-1). Furthermore, the third baseband filter 42-3 is configured to pass yet a different one of the baseband sub-carrier signals. Accordingly, each of the baseband sub-carrier signals includes different data.

In contrast to the recitations of the independent claims, Secord discusses the transmission and reception of the same signal (*i.e.*, same data) on three different sub-carriers. For example, Fig. 1 of Secord shows a transmitter where a data signal x(k) is transmitted using three different sub-carriers to produce the signals A, B, C shown in Fig. 5 of Secord. Further referring to Fig. 5 of Secord, the signals A, B, and C are demodulated by the multipliers 52 using the same random sequence C(i,k) to provide the same baseband signal in the receiver shown in Fig. 5. Accordingly, as understood by the appellants, the baseband signals produced by the multipliers 52 in Fig. 5 of

Secord each include the same data used to produce the three sub-carrier signals in Secord. Accordingly, Secord does not disclose or suggest, for example, down-converting the received signal to **different data** baseband signals in correlating different data baseband signals with a single-wide band pilot signal as recited in the independent claims. Accordingly, Secord also does not disclose or suggest at least the recitations of independent claims 1, 7, 11, 13, 19, 25, and 31 described above.

Appellants further submit that the other cited references (including U.S. Patent No. 6,335,922 to Tiedemann, Jr. et al. and U.S. Patent No. 5,481,570 to Winters) also do not disclose or suggest at least the recitations of the independent claims discussed above.

Appellant also respectfully submit that there is no clear and particular evidence of a motivation or suggestion to combine Huang and Secord as required under section 103. As discussed above, Secord relates to a multi-carrier CDMA system whereas Huang relates to a conventional code division multiple access system (*i.e.* a multi-coding CDMA system). Huang discusses multi-coding, which is nothing more than conventional CDMA, and does not discuss any of the issues related to multiple subcarriers. Again, it appears that the Examiner may be misunderstanding the use of the acronym MC CDMA to be multi-carrier rather than multi-coding as it is actually used in Huang. Accordingly, there is no clear and particular evidence of a motivation or suggestion to combine Huang and Secord as these references relate to very different approaches.

Accordingly, independent Claims 1, 7, 11, 13, 19, 25 and 31 are patentable over Huang and Secord for at least the reasons discussed above. Furthermore, the remaining claims which depend from the independent claims are also patentable for at least the same reasons.

III. Conclusion

In light of the above discussion, Appellant submits that the pending claims are patentable over the cited references and, therefore, requests reversal of the rejections of Claims 1-31.

Respectfully submitted,

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Audra Wooten

APPENDIX A
Pending Claims USSN 09/610,050
Filed July 5, 2000

1. (Previously presented) A receiver for a multi-carrier CDMA system for receiving a signal transmitted on plural sub-carriers each having a known pilot sequence, comprising:

a plurality of down-converters down-converting the received signal to different data baseband signals;

a delay and channel estimator correlating at least one of the different data baseband signals with a single wideband pilot signal, the single wideband pilot signal comprising more than one of the known pilot sequences, to produce an estimate of channel gain and multi-path delay; and

a plurality of' demodulators, one for each of the plural sub-carriers, and operatively coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

2. (Original) The receiver of claim 1 wherein the plurality of down-converters comprise one for each sub-carrier.

3. (Original) The receiver of claim 1 wherein the plurality of down-converters comprise a plurality of sub-carrier down-converters, one for each sub-carrier, and a composite down-converter down-converting the received signal to a composite baseband signal.

4. (Original) The receiver of claim 3 wherein the delay and channel estimator is operatively coupled to the composite down converter for correlating the composite baseband signal. with a composite of the known pilot sequence to produce an estimate of channel gain and multi-path delay.

5. (Original) The receiver of claim 1 wherein the delay and channel estimator comprises a plurality of correlators, one for each sub-carrier, and outputs of each of the plurality of correlators are combined to produce the estimate of channel gain and multi-path delay.

6. (Previously presented) The receiver of claim 1 further comprising a plurality of correlators, one for each down-converter, each correlating one of the baseband signals with the known pilot sequence for one of the sub-carriers, to produce an estimate of channel gain and multi-path delay, and wherein the plurality of demodulators selectively demodulate the different data baseband signals using either the estimate of channel gain and multi-path delay produced by the delay and channel estimator or the estimate of channel gain and multi-path delay produced by the plurality of correlators.

7. (Previously presented) A receiver for a multi-carrier CDMA system for receiving a signal transmitted having a known pilot sequence on plural sub-carriers, comprising:

a plurality of sub-carrier down-converters and filters, one for each sub-carrier, each down-converting the received signal to baseband and removing the other sub-carriers to provide different data sub-carrier baseband signals;

a composite down-converter down-converting the received signal to a composite baseband signal;

a delay and channel estimator operatively coupled to the composite down converter correlating the composite baseband signal with a composite of the known pilot sequence to produce an estimate of' channel gain and multi-path delay; and

a plurality of demodulators, each operatively connected to one of the sub-carrier down-converters and filters and to the delay and channel estimator, each demodulating one of the different data sub-carrier baseband signals using the estimate of channel gain and multi-path delay.

8. (Original) The receiver of claim 7 wherein the composite down converter down-converts the received signal relative to a center carrier frequency and the sub-carriers are separated with respect to the center carrier frequency.

9. (Original) The receiver of claim 8 wherein the composite of the known pilot sequence comprises a sum of the known pilot sequences.

10. (Previously presented) The receiver of claim 7 further comprising a plurality of correlators, one for each down-converter, each correlating one of the different data sub-carrier baseband signals with the known pilot sequence for one of the sub-carriers, to produce an estimate of channel gain and multi-path delay, and wherein the plurality of demodulators selectively demodulate the different data sub-carrier baseband signals using either the estimate of channel gain and multi-path delay produced by the delay and channel estimator or the estimate of channel gain and multi-path delay produced by the plurality of correlators.

11. (Previously presented) A receiver for a multi-carrier CDMA system for receiving a signal transmitted on plural sub-carriers each having a known pilot sequence, comprising:

a plurality of sub-carrier down-converters and filters, one for each sub-carrier, each down-converting the received signal to baseband and removing the other sub-carriers to provide different data sub-carrier baseband signals;

a delay and channel estimator comprising a plurality of correlators, each correlating one of the different data sub-carrier baseband signals with the known pilot sequence for the one sub-carrier, and operative to combine outputs of the plurality of correlators to produce an estimate of channel gain and multi-path delay; and

a plurality of demodulators, one for each of the plural sub-carriers and operatively coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

12. (Original) The receiver of claim 11 wherein the delay and channel estimator identifies multi-paths and relative delays for the multi-paths using threshold comparison.

13. (Previously presented) A method of synthesizing a radio channel profile for a multi-carrier CDMA receiver receiving a signal transmitted on plural sub-carriers, comprising:

down-converting the received signal to baseband and removing the other sub-carriers to provide different data sub-carrier baseband signals;

correlating each of the different data sub-carrier baseband signals with a known pilot sequence to provide correlated different data sub-carrier baseband signals;

sampling each of the correlated different data sub-carrier baseband signals;

transforming each of the sampled, correlated different data sub-carrier baseband signals to a discrete frequency domain;

combining the transformed baseband signals to produce a combined discrete frequency domain signal; and

inverse transforming the combined discrete frequency domain signal to produce a composite correlation output signal.

14. (Previously presented) The method of claim 13 wherein sampling each of the different data correlated sub-carrier baseband signals comprises sampling each of the correlated sub-carrier baseband signals at Nyquist rate.

15. (Previously presented) The method of claim 13 wherein sampling each of the different data correlated sub-carrier baseband signals comprises sampling each of the different data correlated sub-carrier baseband signals at greater than Nyquist rate.

16. (Previously presented) The method of claim 13 wherein transforming each of the sampled, different data correlated sub-carrier baseband signals to a

discrete frequency domain comprises forming discrete Fourier transforms for each of the sampled, different data correlated sub-carrier baseband signals.

17. (Previously presented) The method of claim 13 wherein combining the transformed baseband signals to produce a combined discrete frequency domain signal comprises computing a carrier frequency offset in frequency domain for each of the sub-carriers and summing the transformed baseband signals using the carrier frequency offsets in the frequency domain.

18. (Previously presented) The method of claim 16 wherein inverse transforming the combined discrete frequency domain signal to produce a composite correlation output signal comprises calculating an inverse discrete Fourier transform for the combined discrete frequency domain signal.

19. (Previously presented) A mobile terminal for a multi-carrier CDMA system comprising:

a receiver for receiving a signal transmitted on plural sub-carriers each having a known pilot sequence comprising a plurality of down-converters down-converting the received signal to different data baseband signals ,a delay and channel estimator correlating at least one of the different data baseband signals with a single wideband pilot signal, the single wideband pilot signal comprising more than one of the known pilot sequences, to produce an estimate of channel gain and multi-path delay, and a plurality of demodulators, one for each of the plural sub-carriers, and operatively coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

20. (Original) The mobile terminal of claim 19 wherein the plurality of down-converters comprise one for each sub-carrier.

21. (Original) The mobile terminal of claim 19 wherein the plurality of down-converters comprise a plurality of sub-carrier down-converters, one for each

sub-carrier, and a composite down-converter down-converting the received signal to a composite baseband signal.

22. (Original) The mobile terminal of claim 21 wherein the delay and channel estimator is operatively coupled to the composite down converter for correlating the composite baseband signal with a composite of the known pilot sequence to produce an estimate of channel gain and multi-path delay.

23. (Original) The mobile terminal of claim 19 wherein the delay and channel estimator comprises a plurality of correlators, one for each sub-carrier, and outputs of each of the plurality of correlators are combined to produce the estimate of channel gain and multi-path delay.

24. (Previously presented) The mobile terminal of claim 19 further comprising a plurality of correlators, one for each down-converter, each correlating one of the different data baseband signals with the known pilot sequence for one of the sub-carriers, to produce an estimate of channel gain and multi-path delay, and wherein the plurality of demodulators selectively demodulate the different data baseband signals using either the estimate of channel gain and multi-path delay produced by the delay and channel estimator or the estimate of channel gain and multi-path delay produced by the plurality of correlators.

25. (Previously presented) A base station for a multi-carrier CDMA system comprising:

a receiver for receiving a signal transmitted on plural sub-carriers each having a known pilot sequence comprising a plurality of down-converters down-converting the received signal to different data baseband signals, a delay and channel estimator correlating at least one of the different data baseband signals with a single wideband pilot signal, the single wideband pilot signal comprising more than one of the known pilot sequences, to produce an estimate of channel gain and multi-path delay, and a plurality of demodulators, one for each of the plural sub-carriers, and operatively

coupled to the delay and channel estimator, each demodulating one of the different data baseband signals using the estimate of channel gain and multi-path delay.

26. (Original) The base station of claim 25 wherein the plurality of down-converters comprise one for each sub-carrier.

27. (Original) The base station of claim 25 wherein the plurality of down-converters comprise a plurality of sub-carrier down-converters, one for each sub-carrier, and a composite down-converter down-converting the received signal to a composite baseband signal.

28. (Original) The base station of claim 27 wherein the delay and channel estimator is operatively coupled to the composite down converter for correlating the composite baseband signal with a composite of the known pilot sequence to produce an estimate of channel gain and multi-path delay.

29. (Original) The base station of claim 25 wherein the delay and channel estimator comprises a plurality of correlators, one for each sub-carrier, and outputs of each of the plurality of correlators are combined to produce the estimate of channel gain and multi-path delay.

30. (Previously presented) The base station of claim 25 further comprising a plurality of correlators, one for each down-converter, each correlating one of the different data baseband signals with the known pilot sequence for one of the sub-carriers, to produce an estimate of channel gain and multi-path delay, and wherein the plurality of demodulators selectively demodulate the different data baseband signals using either the estimate of channel gain and multi-path delay produced by the delay and channel estimator or the estimate of channel gain and multi-path delay produced by the plurality of correlators.

31. (Previously presented) A method of synthesizing a radio channel profile for a multi-carrier CDMA receiver receiving a signal transmitted on plural sub-carriers, comprising:

down-converting the received signal to baseband and removing the other sub-carriers to provide different data sub-carrier baseband signals;

correlating each of the different data sub-carrier baseband signals with a known pilot sequence to provide correlated different data sub-carrier baseband signals;

sampling each of the correlated different data sub-carrier baseband signals; and

combining the correlated different data sub-carrier baseband signals to produce a combined signal.